OCO-2 Status
November 20, 2017

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Jet Propulsion Laboratory, California Institute of Technology

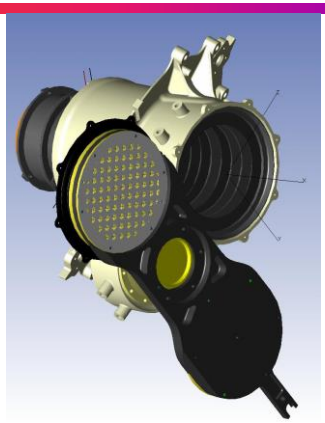
Overview

- Observatory Status: Nominal
- Instrument Status: Nominal
- A quick look back at the Opportunistic Science data
- Overview of near-term plans for L2 algorithm evolution
- Upcoming Events
  - Fall AGU: 11-15 December 2017 in New Orleans
  - GOSAT/OCO-2 Technical Interface Meeting at AGU
    - Tuesday, December 12 from 11 to 1:30, Location TBD near New Orleans Convention Center
  - 98th Annual AMS Meeting: 8-12 January in Austin Texas

OCO-2 is Back To Nominal (Autonomous) Operations

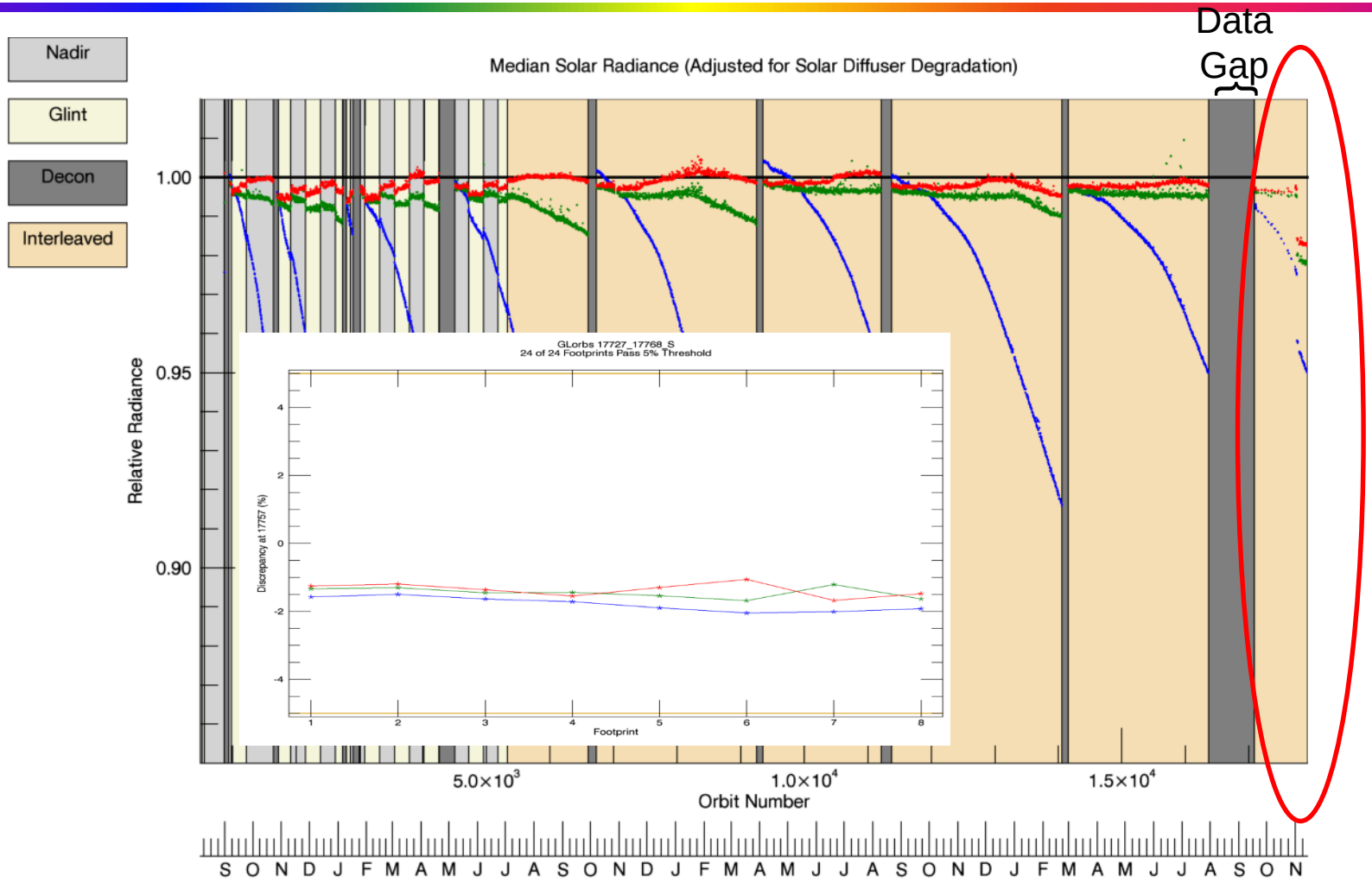
- After 1.5 months of down time and an almost equal period of "Opportunistic Science" (~2/3 science duty cycle), OCO-2 resumed nominal autonomous science and calibration operations on 11/4/2017.
  - Observatory operations are once-again commanded via a weekly Absolute Time Sequence running onboard the spacecraft.
  - This sequence autonomously controls BCA operations without the need for daily commanding from the ground
  - The mission operations and calibration team are monitoring the actual performance of the 2.5 degree solar pointing offset
- We are aware of no issues with the data collected during the Opportunistic Science period, and encourage its use. If you encounter any issues with it, please let us know immediately

A Quick Look Back at Opportunistic Science



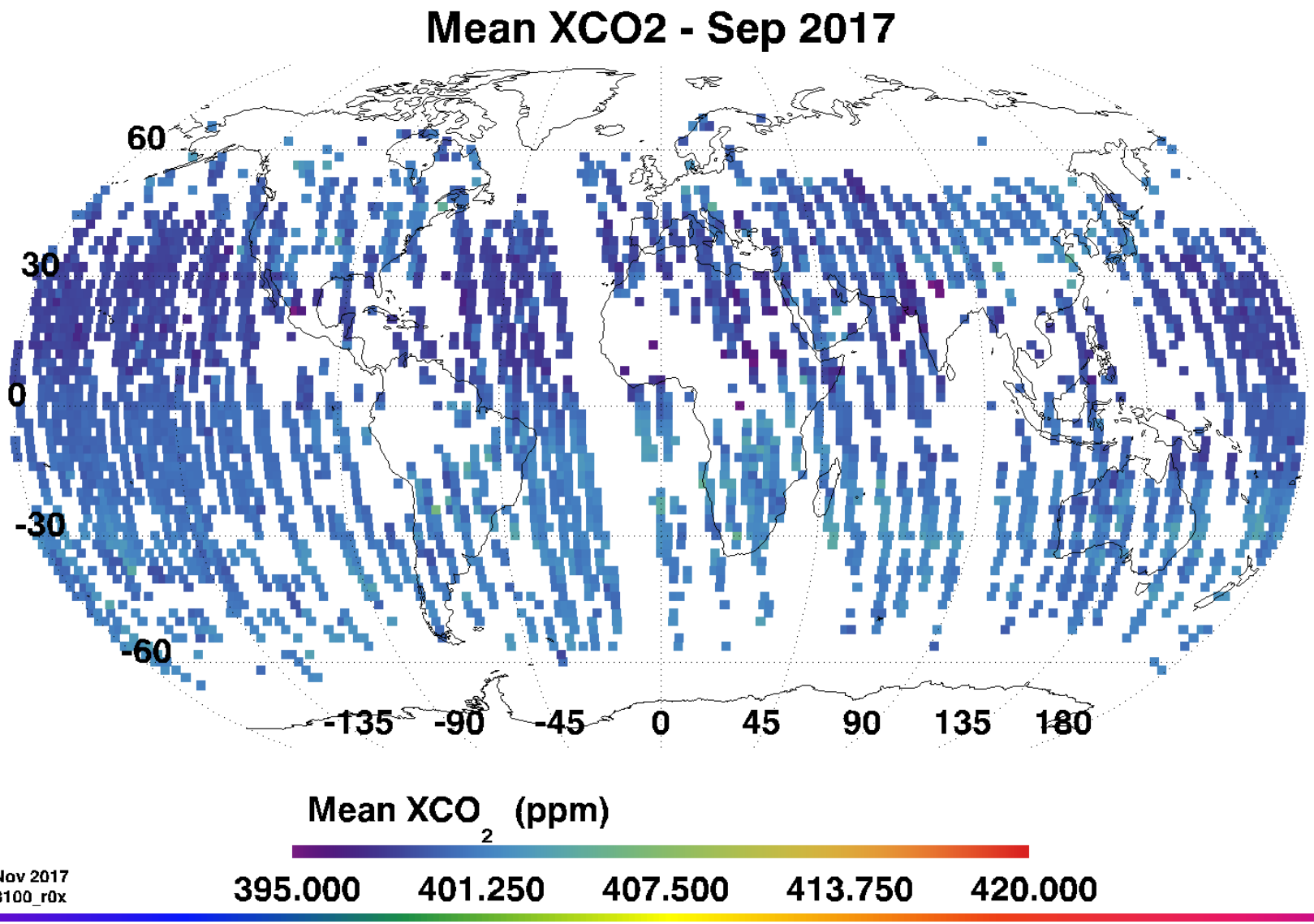
- History of Opportunistic Science (OS)
  - Last good pre-OS orbit: July 30th, 2017, orbit 16365
  - Data Gap: July 30 – September 18th
  - First OS orbit: September 19th, 2017, orbit 17115
  - Last OS orbit: November 4th, 2017, orbit 17784
  - Return to Nominal Operations, 4 November 2017, Orbit 17785
- The 2.5 degree solar pointing offset produced a 1-2% change in the illumination level for solar calibration
  - More than expected from cosine effects alone (<1%)
    - Thought to be associated with non-uniform illumination of instrument pupil by solar calibrator
  - Less than the Go/No-Go requirement for return to nominal operations (5%)

Degradation Trending during OS

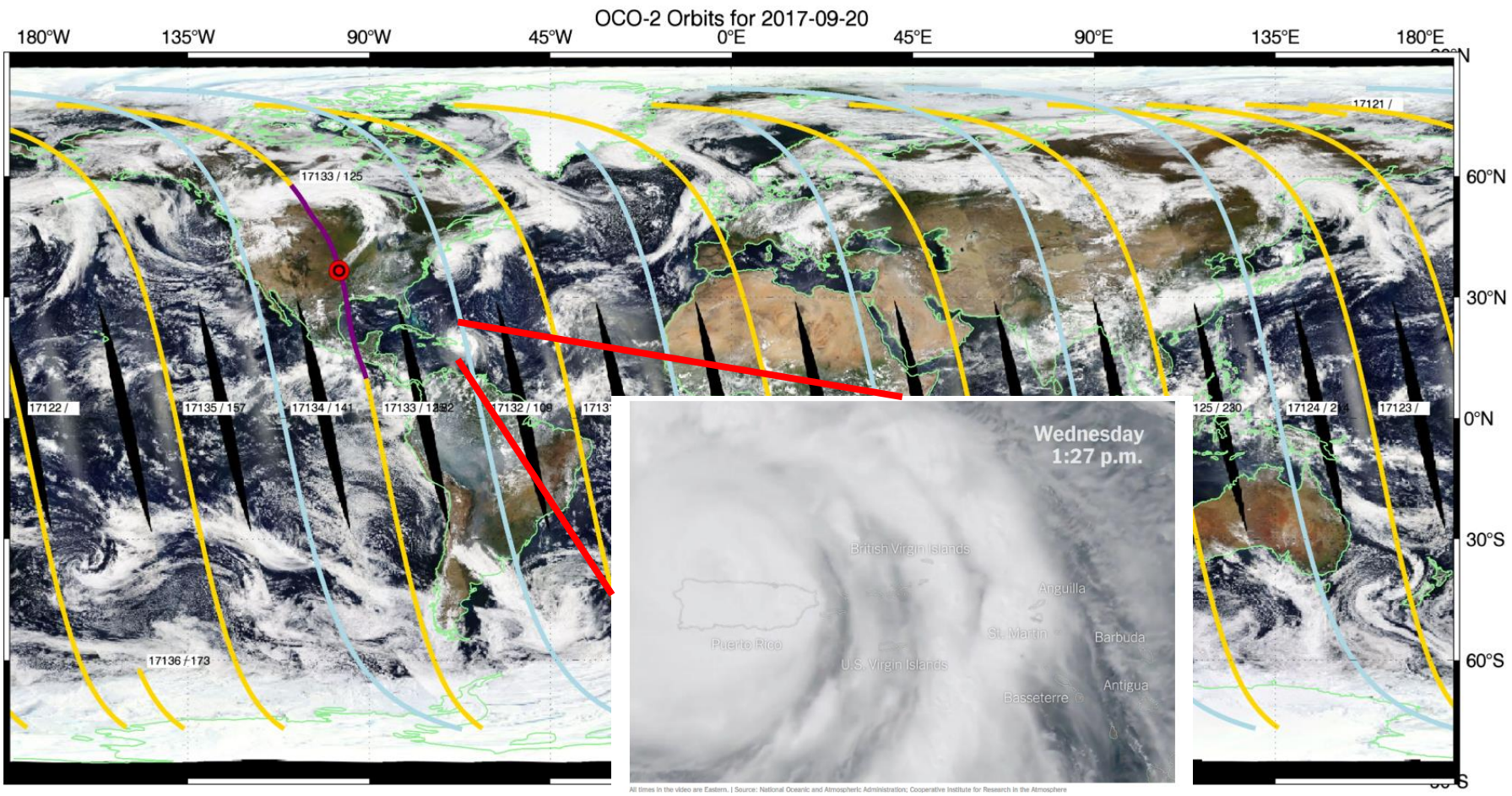


Changes in the solar pointing, and a possible small change in the diffuser door position are being accommodated in calibration process.

OS coverage for September 2017

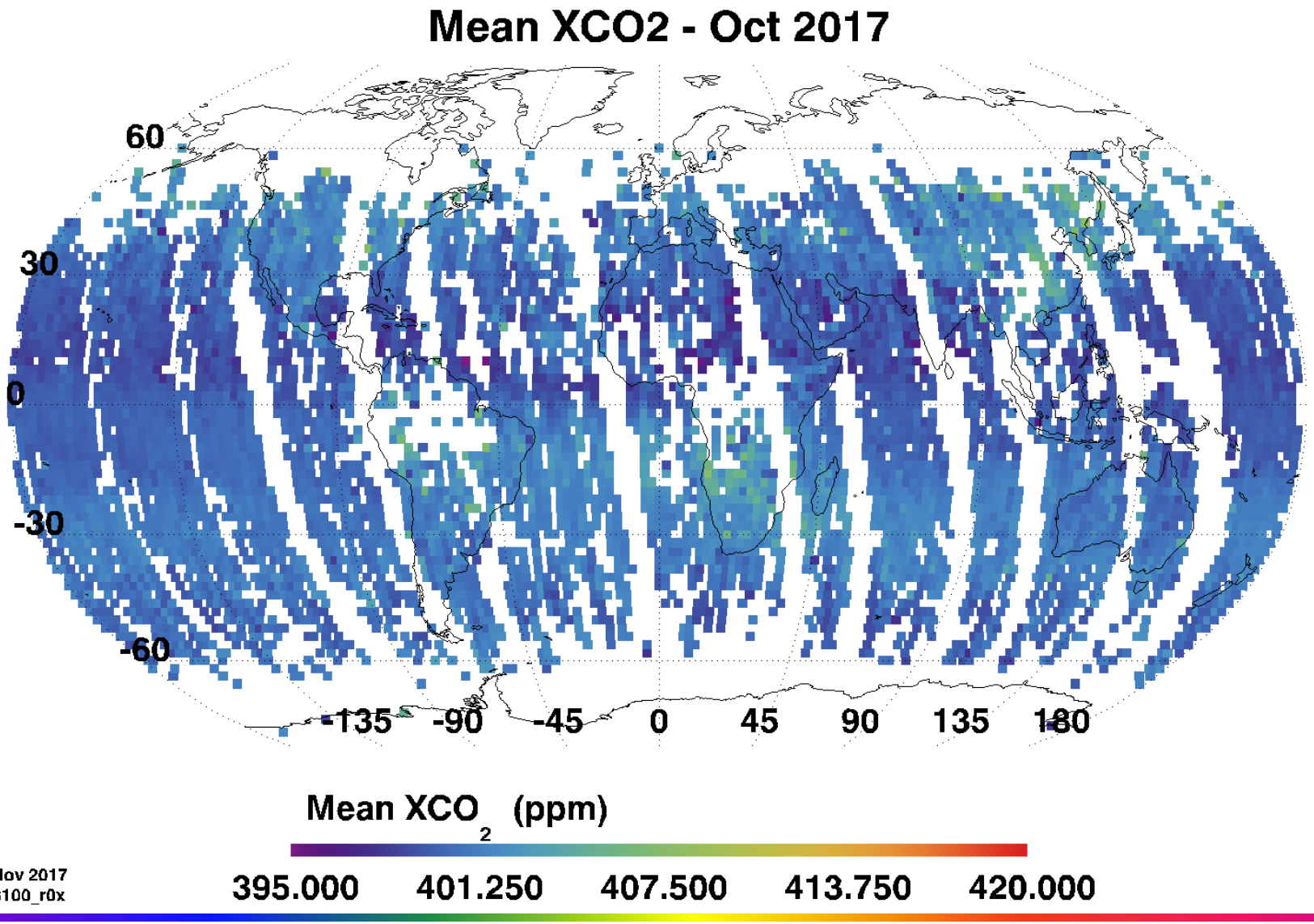


Overflight of Puerto Rico and Hurricane Maria

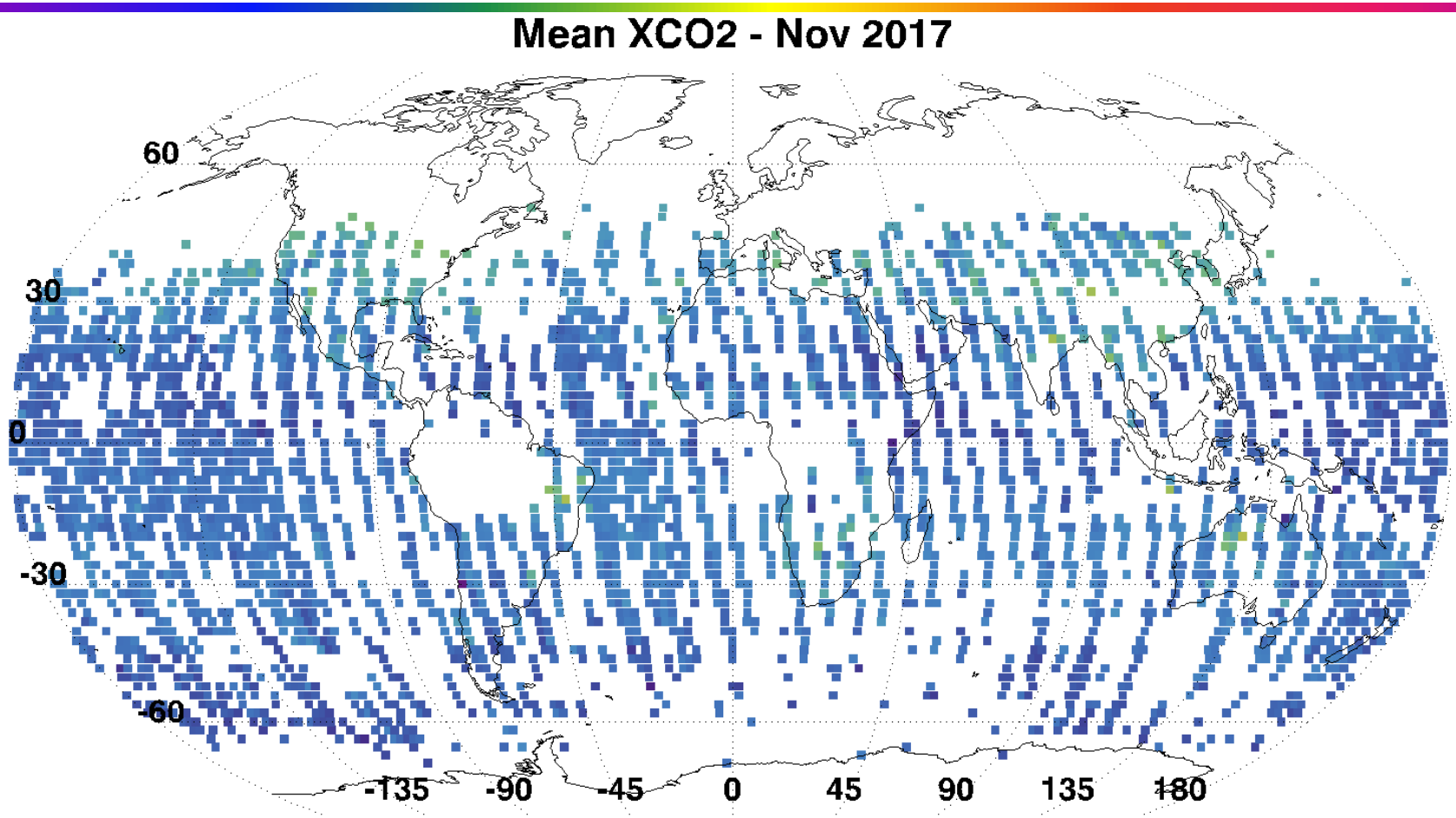


It looks like OCO-2 few over Puerto Rico, just as Hurricane Maria arrived.
It might be useful to extract the cloud top pressures.

OS Coverage for October 2017



OS Coverage for November 2017
- so far -



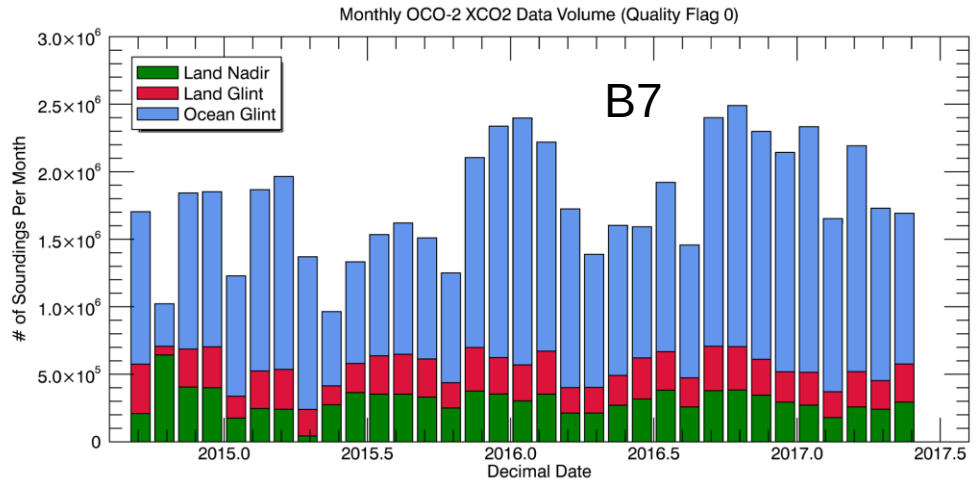
Brief Overview of the Version 8 (B8) Product

Chris O'Dell et al.

Major Differences in the B8 Product

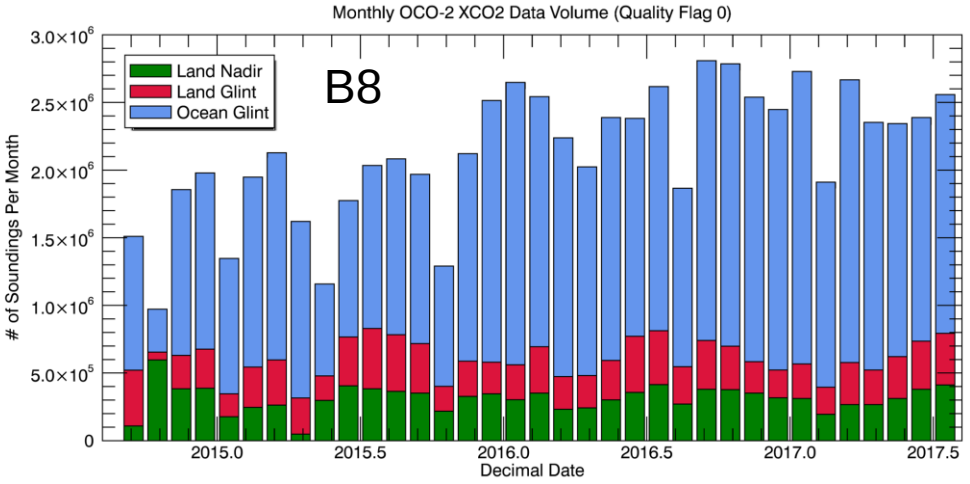
- Improved L1B Spectra
  - Fast (icing) and slow (solar diffuser) degradation corrected
  - Correction zero level offset from backscattering of light from ice film that accumulates on A-band detector between decon cycles.
- Improved L2 retrieval
  - Inclusion of an optically-thin, stratospheric aerosol type
  - More realistic land surface (soil BRDF)
  - ABSCO Update 4.2 vs 5.0
  - Prior Meteorology Update, ECMWF → GEOS5 (FP-IT)
  - Other small improvements
    - Updated X_{CO2} and Cirrus prior
    - Updated cloud screening, bias correction, and warn levels

Improved Yield

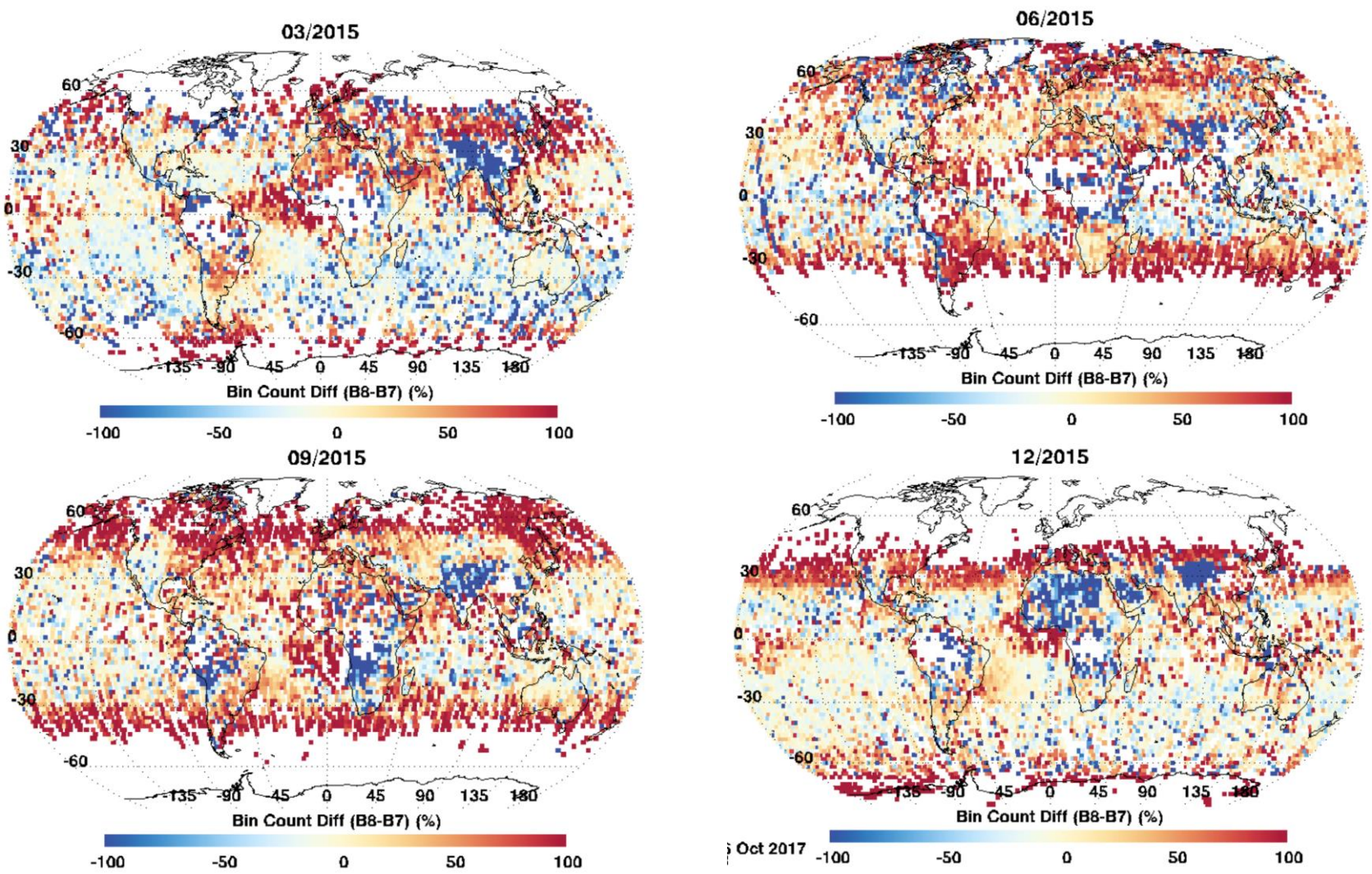


The sounding yield for B7 was ~7% (2 million soundings/month) once the optimal observing scheme was implemented.

Improvements in the cloud screening algorithm and other changes in the L2 algorithm increased the B8 yield to > 8%, with the largest changes seen in the tropics and at at high latitudes

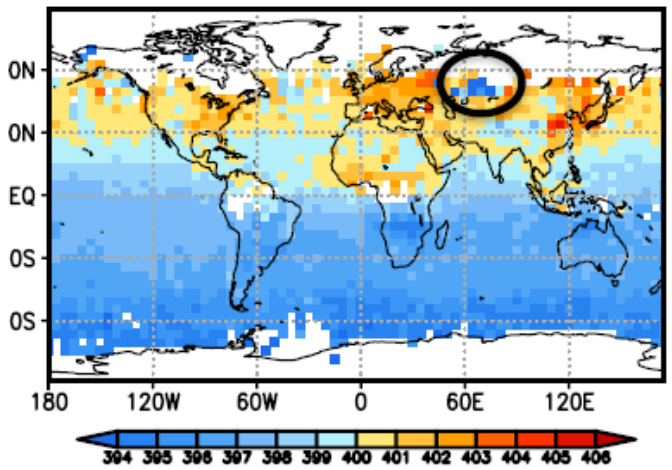


B8-B7 Sounding Density (O'Dell et al.)

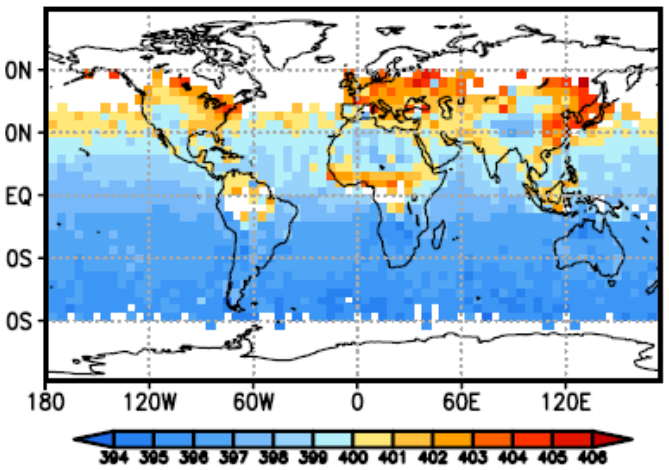


Differences in Coverage between B7 and B8
(Liu et al.)

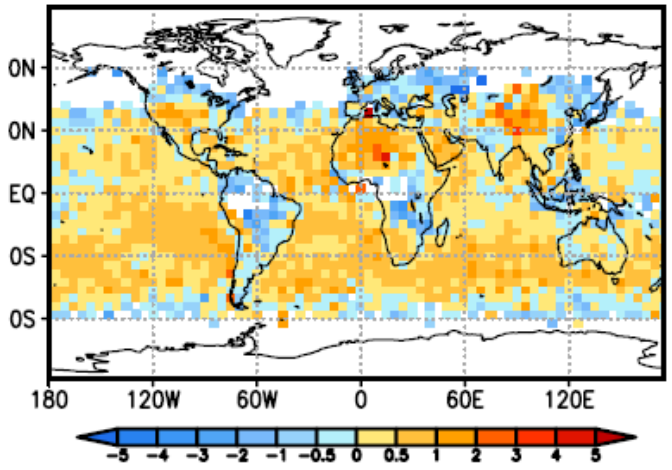
Jan-March, 2015, B8



Jan-March, 2015, B7



B8-B7, Jan-March, 2015

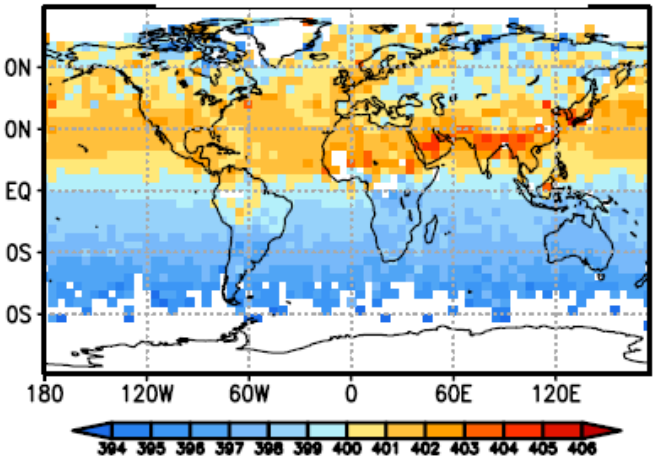


B8 has substantially more coverage than B7 at high latitudes in the winter hemisphere, but some of the results appear to be anomalous – such as the low values seen over central Asia

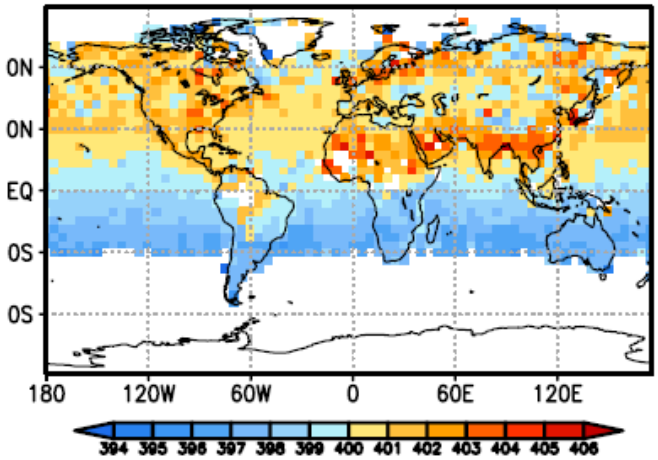
Differences in Coverage between B7 and B8

(Liu et al.)

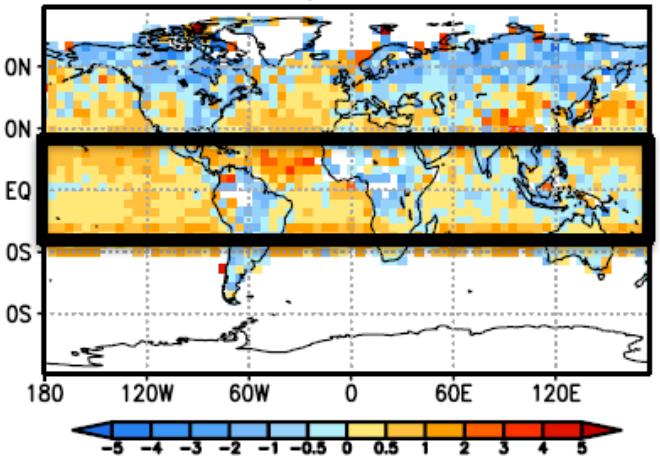
April-June, 2015 B8



April-June, 2015 B7



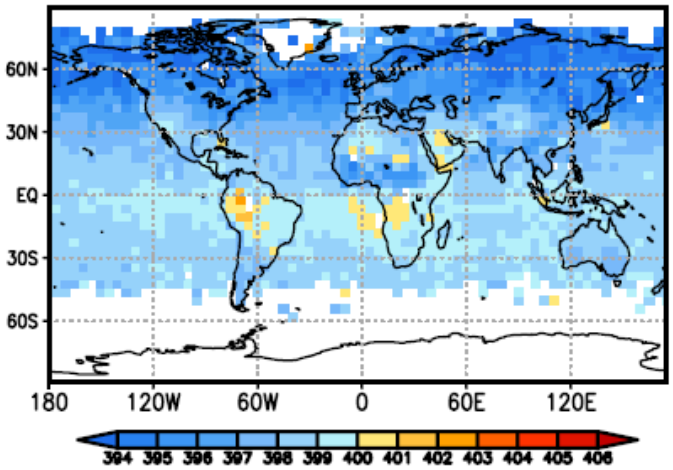
B8-B7



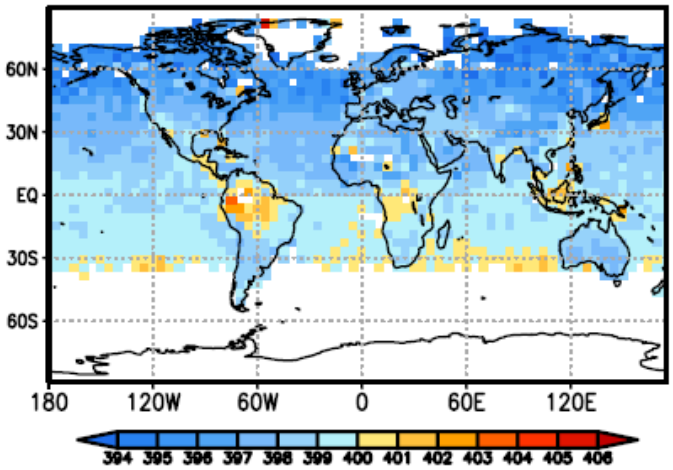
- Land and ocean gradient becomes smaller in B8
- B8 is lower than B7 over tropical land.

Differences in Coverage between B7 and B8
(Liu et al.)

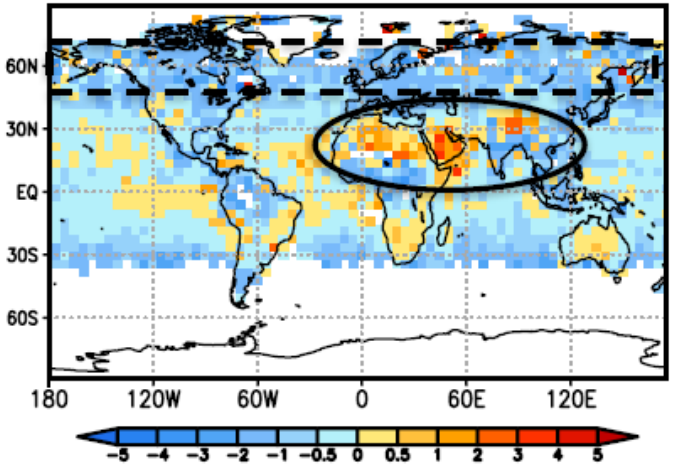
July-Sept, 2015 B8



July-Sept, 2015 B7



B8-B7

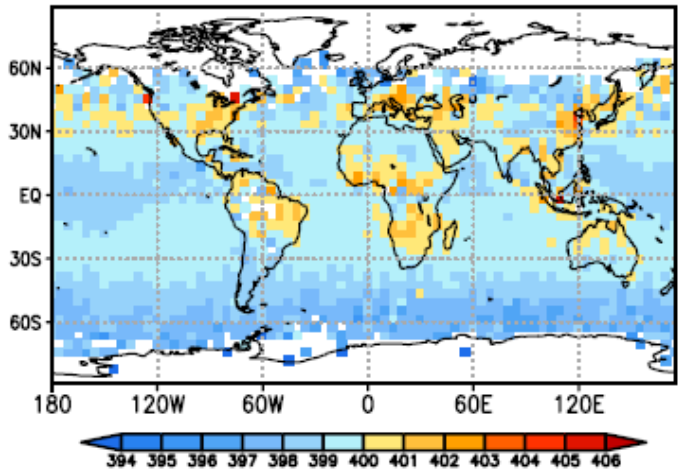


- B8 has much larger summer drawdown than B7 over the NH.
- B8 and B7 have large differences over desert and Tibetan Plateau

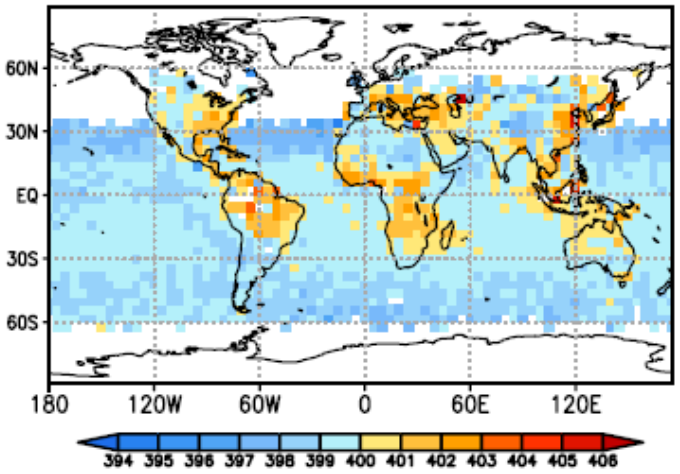
Differences in Coverage between B7 and B8

(Liu et al.)

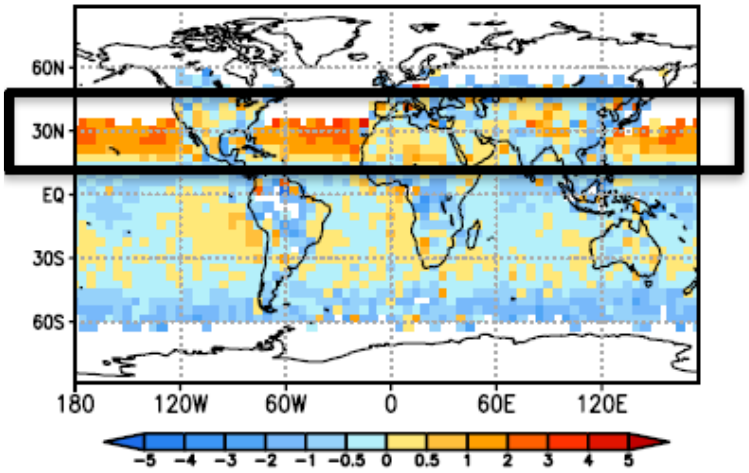
Oct-Dec, 2015 B8



Oct-Dec, 2015 B7



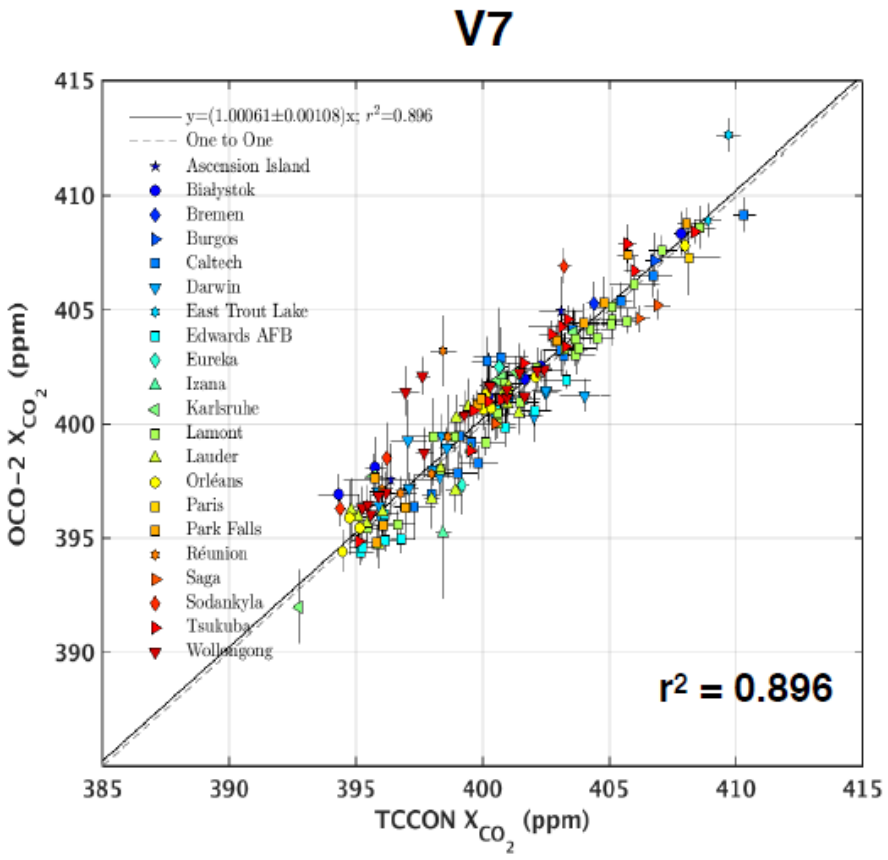
B8 - B7

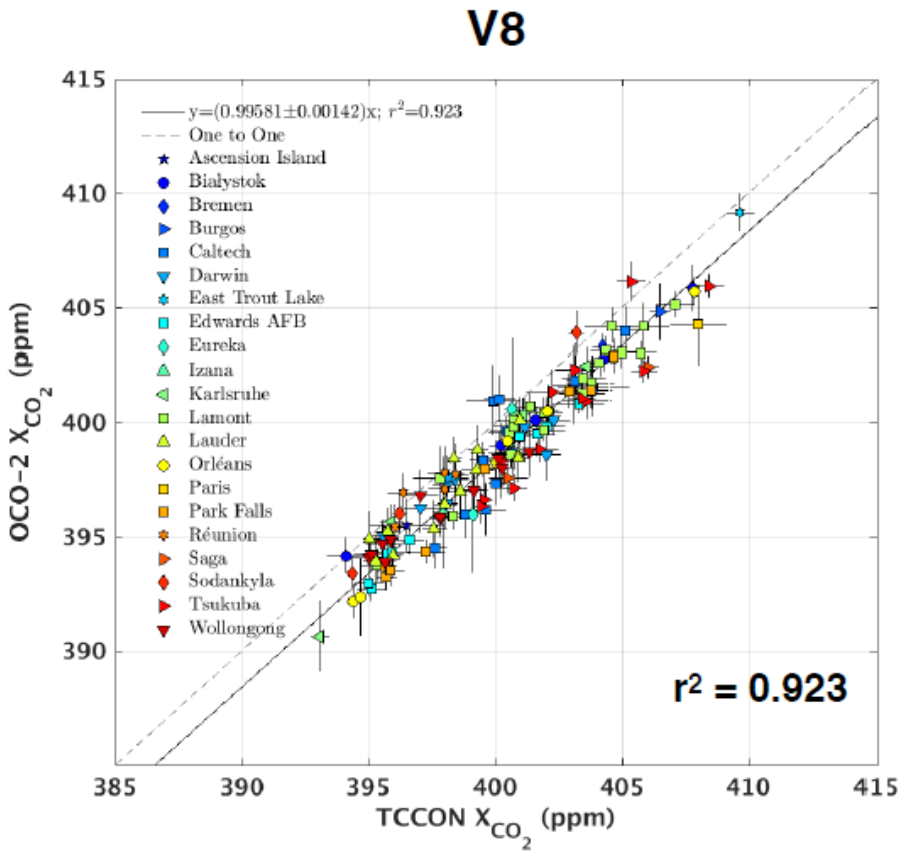


- Very large changes with B8 ocean glint that reduced the land-ocean gradient

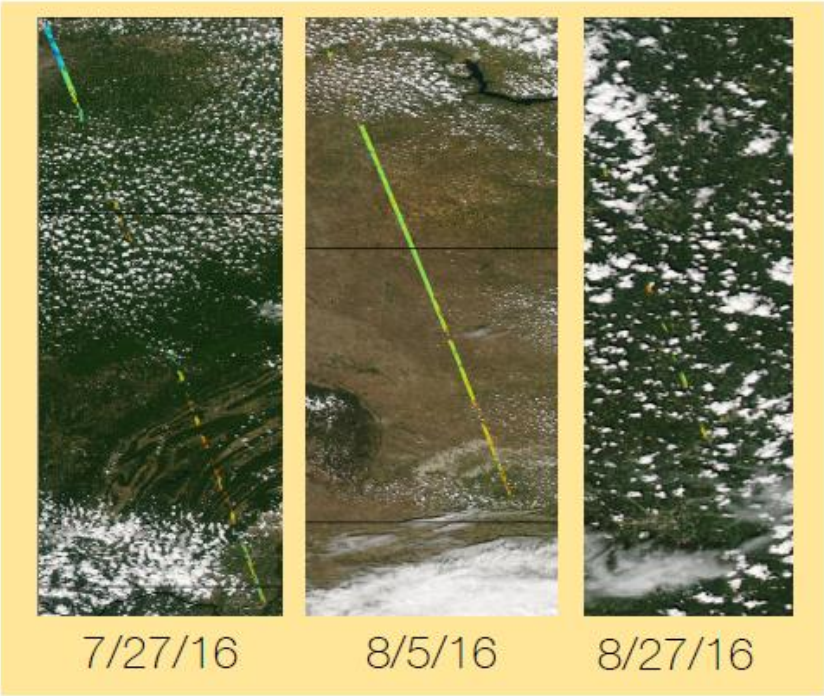
Comparisons to TCCON – Comparison to V7

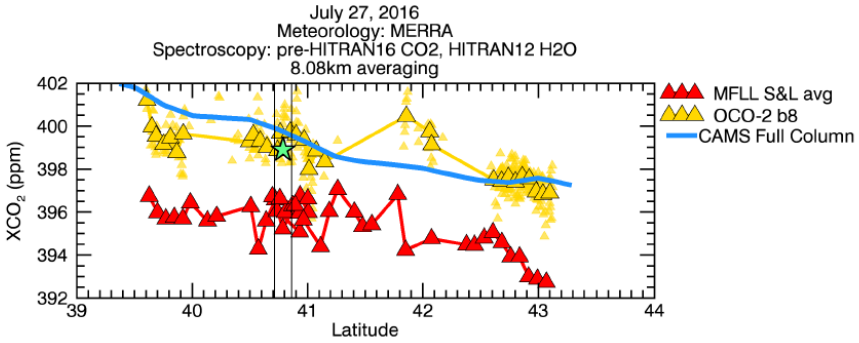
(Kiel et al.)





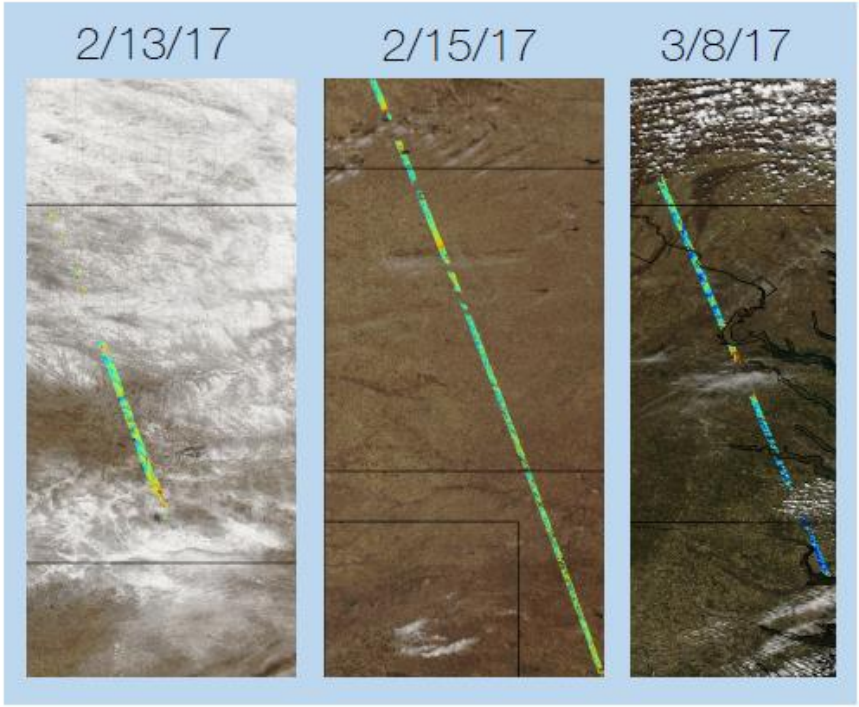
Cross Validation with ACT-America
(Bell et al.)





7 OCO-2 underflights so far…

Winter



Summary of B8 – B7 Differences (Liu et al.)

- The B8 product has a better overall agreement with TCCON and other truth metrics
- B8 X_{CO2} is lower than B7 X_{CO2} over tropical land, but
- higher over the tropical ocean;

  => Land-ocean gradient in B8 is much smaller;
- B8 X_{CO2} is lower than B7 X_{CO2} during summer, but higher during winter in the NH.

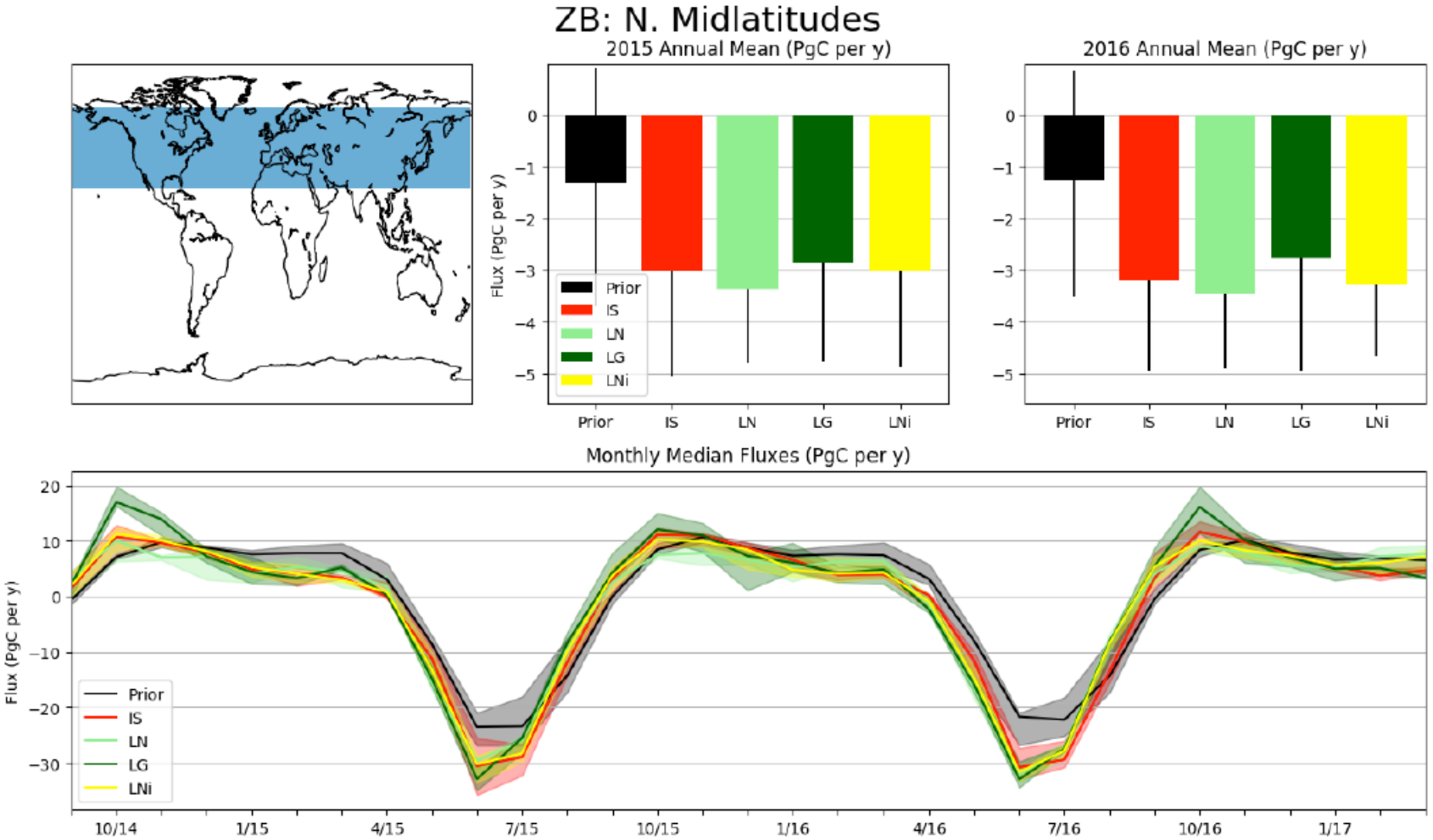
  => B8 has larger seasonal amplitude than B7 over NH
- B8 and B7 have large X_{CO2} differences over high topography and bright surfaces, such as desert.
- B8 X_{CO2} over land is lower than B7 X_{CO2} over land, and the difference becomes larger in 2016.

Flux inversion group activities

D. Baker et al.

- A preliminary Level 4 OCO-2 flux product is under development
  - Preliminary efforts to produce this product were reviewed at the October OCO-2 Science Team meeting
- Two rounds of flux inversion MIPs: Sept 2014 – March 2017
  - Fluxes derived for Sept 2014 to March 2017
  - This period included most of the 2015-16 El Niño, but missed the end
  - Extra year allows seasonal cycles to be assessed
  - 9 inversion groups submitted results
- Topics currently under discussion:
  - Which results are (most) believable?
  - How do we form the L4 flux product from the MIP ensemble?
  - What do we distribute to the community?

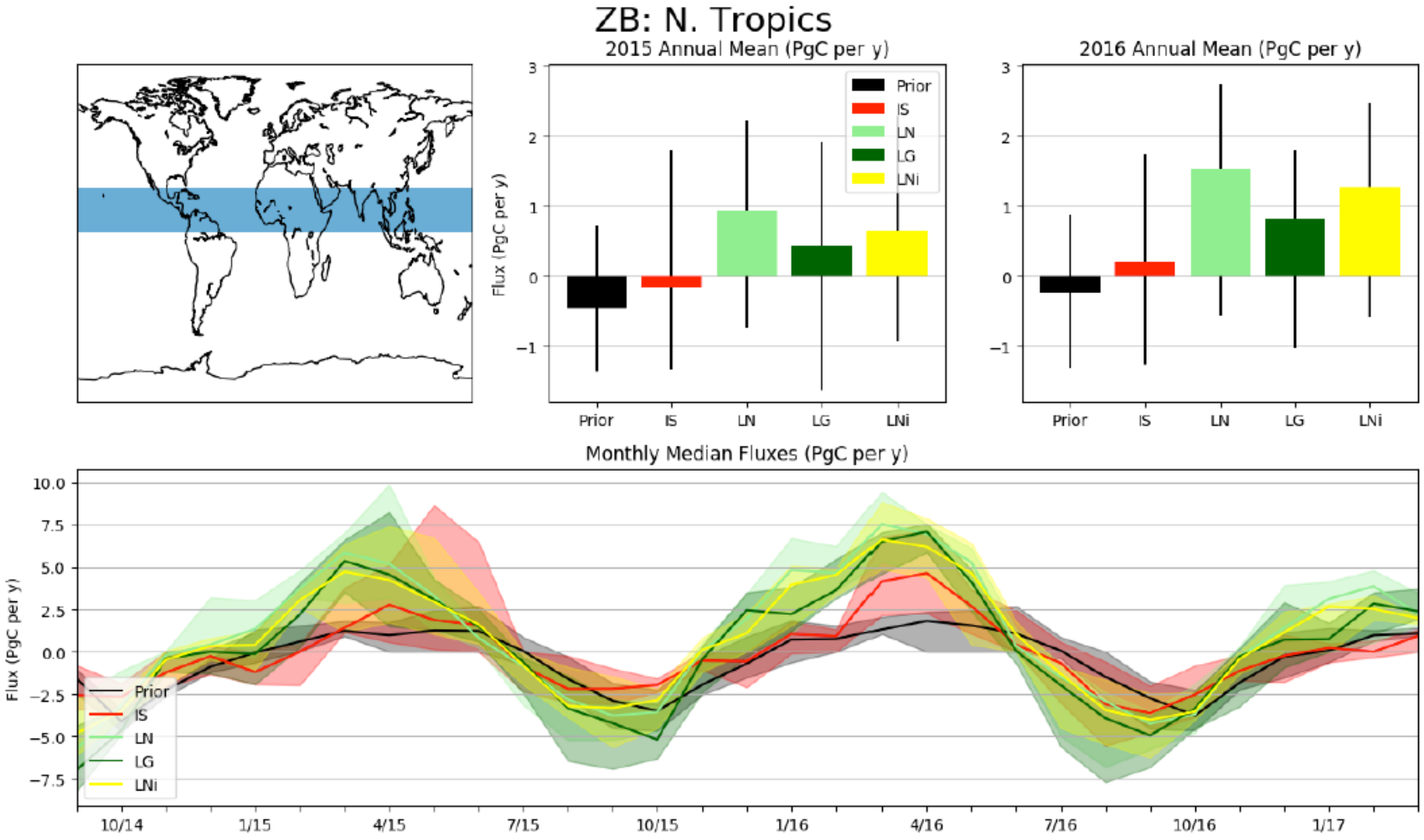
Preliminary L4 Results: Northern Mid-latitudes (Sean Crowell et al.)



Inversions using OCO-2 XCO2 (B7) have a larger seasonal cycle than prior or simulations using only in situ observations. The phase is also shifted earlier.

Preliminary L4 Results: N. tropics

Sean Crowell et al.



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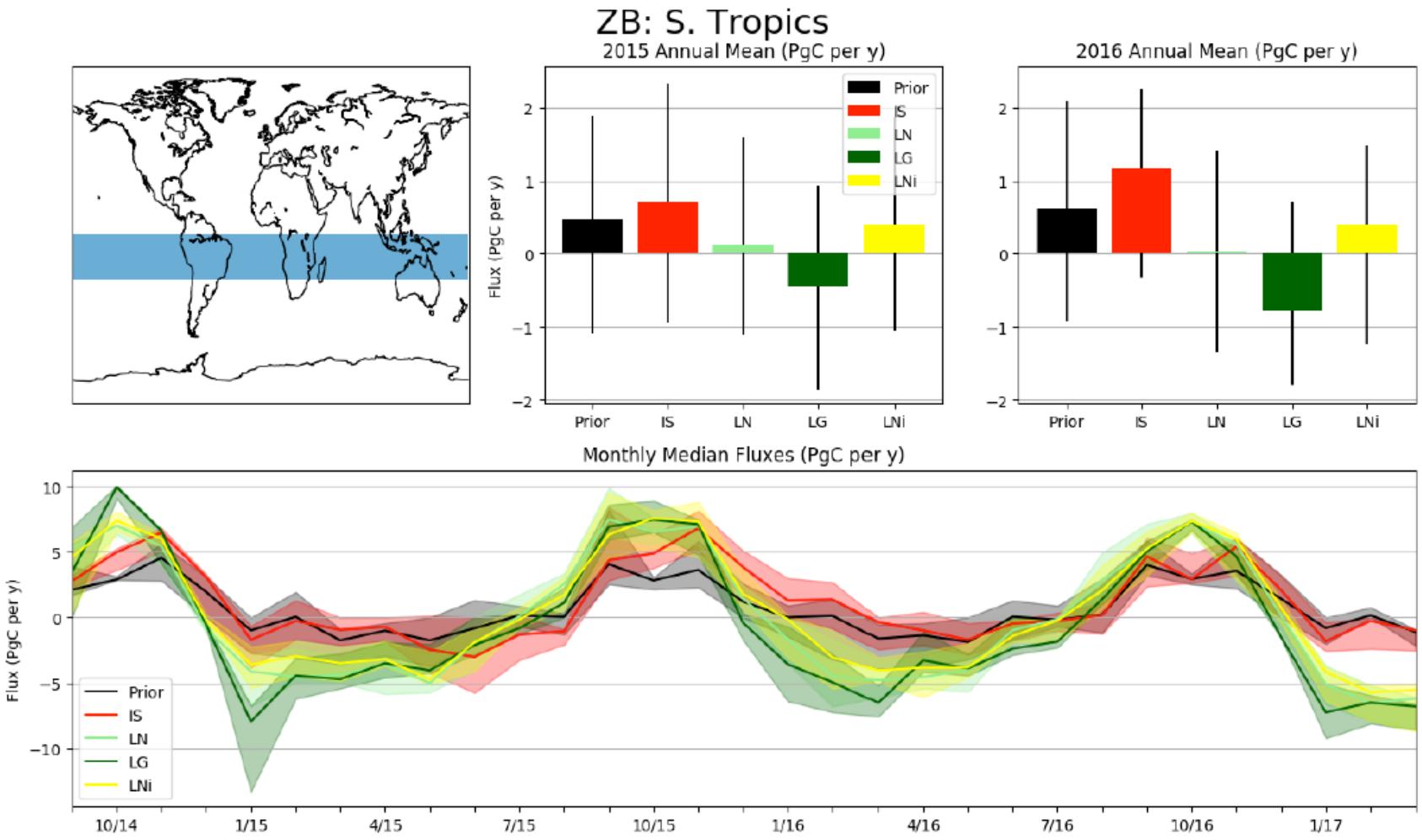
Preliminary L4 Results: S. tropics

Sean Crowell et al.



Inversions using OCO-2 XCO2 (B7) have a larger seasonal cycle than prior or simulations using only in situ observations. The phase is also shifted earlier.

Preparations for the GOSAT/OCO-2 TIM at AGU

The Annual OCO-2/OCO-3/GOSAT/GOSAT-2 Technical Interface Meeting (TIM) at AGU

- 11:00 – 1:00 PM on Tuesday, December 12th.
- We have requested a meeting room that holds at least 40 people in the vicinity of the Ernest N. Morial Convention Center in New Orleans.
- We have requested a projector and a screen to support presentations.
- We have designated the meeting as a invitation-only programmatic meeting. The team leads can designate their representatives.

Purpose:

This meeting will exploit the availability of GOSAT and OCO-2 Science team members at the AGU meeting to facilitate the coordination of ongoing efforts to cross calibrate the OCO-2 and GOSAT measurements and to cross validate the GOSAT and OCO-2 products. It will provide an opportunity to discuss options for future vicarious calibration activities, as the OCO-2, OCO-3, GOSAT, and GOSAT-2 programs. It will provide us an opportunity to exchange information on the status of OCO-2 and GOSAT, the development of GOSAT-2 and OCO-3, and the plans for GOSAT-3.